

# Rabies (Human and Animal)

(Also known as Hydrophobia and Lyssa)

Report Human Cases Immediately

## 1) THE DISEASE AND ITS EPIDEMIOLOGY

### A. Etiologic Agent

The virus that causes rabies is a rhabdovirus of the genus *Lyssavirus*.

### B. Clinical Description

#### Animal Rabies

Rabies is primarily a disease of the central nervous system. Animals with rabies can appear aggressive (“furious rabies”) or normal or meek (“dumb rabies”). Animals with furious rabies often exhibit aggressive or unusually excited behavior; they may excessively salivate and attack other animals or humans. Dumb rabies may be more difficult to detect; animals may seem tame, wounded, or dazed. These animals have been described as acting “drunken,” disoriented, or suffering from some paralysis. The behavior of an animal, however, is *not* a reliable indicator of whether it has rabies.

#### Human Rabies

Rabies is almost always a fatal infection. A progressive illness of approximately 2–21 days follows an incubation period. A prodromal phase, lasting about 2–10 days, is characterized by pain and numbness/tingling at the site of the bite (present in 50–80% of cases) and nonspecific complaints such as fatigue, headache and fever. Behavioral changes may also be apparent, including apprehension, anxiety, agitation, irritability, insomnia and depression.

The prodromal phase is followed by the neurologic phase during which the following can occur: disorientation and hallucinations; paralysis; episodes of terror and excitement; hydrophobia; hyperventilation; hypersalivation; and seizures. These symptoms are invariably followed by coma and death. Once symptoms have begun, drugs or treatments do not improve the patient’s condition.

### C. Reservoirs

Although all species of mammals are susceptible to rabies virus infection, only a few species are important for maintaining the disease in nature. In the United States, raccoons, skunks, foxes and coyotes are the major reservoirs in ground animals, with bats being the major non-ground animal reservoir. Two strains of rabies are present in Massachusetts, bat strain and raccoon strain. In developing countries, dogs remain the principal problem. Any of these strains can be passed to other animals and humans through exposure to contaminated saliva. Small rodents and lagomorphs (*e.g.*, squirrels, hamsters, guinea pigs, gerbils, chipmunks, rats, mice, wild rabbits and hares) have not been known to transmit rabies to humans and are almost never found to be infected with rabies. The exception is rodents and lagomorphs (specifically rabbits) caged outdoors, since these cages allow exposure to rabid animals but provide enough protection so that smaller animals survive and then go on to develop the disease.

#### **D. Modes of Transmission**

Rabies is spread through the virus-laden saliva of an infected animal through a bite, scratch, or contact with mucous membranes or a fresh break in the skin. Bites by some animals, such as bats, can inflict injury so minor that it goes undetected. Also, indirect exposure to saliva of a rabid animal can occur through contact with a pet that has had recent contact with a rabid animal. Skin break or mucous membrane exposure to nervous tissue (brain, spinal cord) of an infected animal may also pose a risk of transmission. After thousands of years of reports on rabies, no direct person-to-person transmission has been documented. However, there have been cases documented after corneal transplants from infected individuals. Airborne spread (for example, in a cave with a multitude of bats or in a laboratory with rabies virus or specimens) has occurred. Rabies is not transmitted through contact with blood, urine, skunk spray, or feces of an infected animal.

#### **E. Incubation Period**

##### **Animal Rabies**

Depending on the animal, the incubation period may vary from a few days to several years, but typically lasts 1 to 3 months. Some animals, such as dogs and cats, have been studied extensively, and the incubation period of these animals rarely exceeds 6 months.

##### **Human Rabies**

The incubation period is usually 3 to 8 weeks, but can be as short as 9 days (although 9-day incubation periods have not been documented in the US with native strains) or as long as 7 years. Fewer than 1% of human cases have an incubation period longer than 6 months. The incubation period is typically related to the site of exposure; *e.g.*, the incubation period is usually shorter if the virus is inoculated closer to the central nervous system or in an area that is more highly innervated (such as the hand). The incubation period also depends on the severity of exposure (more virus results in a shorter incubation period) and the age of the exposed person (younger age generally results in a shorter incubation period).

#### **F. Period of Communicability or Infectious Period**

##### **Animal Rabies**

Animals are not infectious until virus appears in their saliva, and this can happen anytime during the incubation period but probably not sooner than 2 weeks after being infected. Dogs, cats and ferrets may shed virus for about 3–7 days before the onset of clinical signs and continue throughout the course of illness. The shedding/communicability period for most wild animals has not been determined, although skunks may shed virus up to 18 days before death. Carcasses of animals with rabies may contain infectious virus, depending on temperature and environmental conditions. Rabies virus may persist in a frozen carcass for many weeks. Drying and sunlight rapidly deactivate rabies virus. A dried carcass would not contain live rabies virus.

##### **Human Rabies**

The period during which a patient is infectious may begin up to 1 week before symptom onset and last until death. Saliva is considered potentially infectious as are other bodily tissues and fluids (although viral concentrations in humans with rabies are 3–4 times lower than in dogs). It should be noted, however, that with the exception of corneal transplants from infected persons, there have been no documented cases of person-to-person transmission of rabies.

#### **G. Epidemiology**

##### **Animal Rabies**

Animal rabies exists in most parts of the world. In the United States, Hawaii is the only state that has never reported an indigenously acquired rabies case in humans or animals. Wild animals accounted for nearly 92% of reported cases of animal rabies in the US in 1998. Raccoons continued to be the most frequently reported rabid wildlife species (44% of all animal cases during 1998), followed by skunks (28.5%), bats (12.5%), foxes (5.5%), and other wild animals, including rodents and lagomorphs (0.9%). Most of the continental US has

endemic rabies in terrestrial mammals; bat rabies is endemic in Alaska as well as throughout the continental US. Dogs are a primary reservoir for rabies in Mexico and much of Central and South America, Asia, and Africa. In the United States, children are exposed to rabid and potentially rabid animals more often than are adults.

In Massachusetts, the terrestrial (raccoon) rabies epidemic began in 1992, with peak years in 1994 and 1998. Rabies moves in cycles through the animal population. Summer months are peak months for exposures to animals, as people and animals are both outside and likely to encounter each other. From 1992 through 1999 over 2700 animals tested positive for rabies, including 76 cats and 3 dogs. Nearly all towns in Massachusetts have had rabid animals reported, with the exception of Cape Cod and the Islands. The Cape and Islands have remained free of raccoon rabies due to a program that distributes oral vaccine to ground wildlife.

### **Human Rabies**

In the United States over the past century, the number of human deaths attributed to rabies has declined from 100 or more each year to an average of 1 to 2 each year. The decline is due to pet vaccination and animal control programs begun in the 1940s that have practically eliminated the domestic dog as a reservoir of rabies, and to the development of effective human rabies vaccine and immune globulin. Since 1980, 36 human rabies deaths in the United States have been reported to the Centers for Disease Control and Prevention (CDC), with 21 of those associated with bat variants. Twelve of these deaths are believed to have been caused by contact with rabid animals (mostly dogs) outside the United States. Worldwide, an estimated 35,000–40,000 human rabies deaths occur each year. The vast majority of these deaths occur in developing countries. The last indigenous case of human rabies in Massachusetts was in 1934 and was due to the dog strain. There was a human case in a Massachusetts resident in 1983, although the disease was contracted in Africa after a dog bite.

## **2) REPORTING CRITERIA AND LABORATORY TESTING SERVICES**

### **A. What to Report to the Massachusetts Department of Public Health**

#### **Animal Rabies**

Rabies in animals is reportable to the Massachusetts Department of Public Health (MDPH). However, since all animal testing for rabies in Massachusetts is done by the Massachusetts State Laboratory Institute (SLI), the flow of testing information will generally be from the MDPH to the local health department.

#### **Animal Bites**

Animal bites are *not* reportable to the MDPH. However, an epidemiologist is available 24/7 for consultation on animal bite management regarding possible rabies exposures. *Note:* Animal bites are reportable to most local health departments.

#### **Human Rabies**

Report any suspect case of human rabies based on a healthcare provider's medical opinion or a laboratory result indicating rabies.

#### **Administration of Rabies Post-Exposure Prophylaxis**

The administration of rabies post-exposure prophylaxis (PEP) which is rabies vaccine and/or human rabies immune globulin is also reportable to the MDPH by the healthcare provider. There is a MDPH *Initiation of Rabies Post-Exposure Prophylaxis Reporting Form* (in Appendix A) specifically for this purpose, and the healthcare provider at the site where the treatment is administered usually completes it. Remind healthcare providers who are administering PEP of this requirement.

## B. Laboratory Testing Services Available

### Animal Rabies

Animals are tested at the State Laboratory Institute (SLI). Local health departments must make arrangements for testing and transport of specimens to the SLI. Animal control officers and veterinarians need to be familiar with the proper way to kill, preserve and ship the animals to the laboratory. Except for whole bats and other very small animals, only heads will be accepted. For more information on submitting specimens contact the SLI, Rabies Laboratory at (617) 983-6385. All animal test results performed at the SLI are reported to the local health department.

### Human Rabies

All clinical samples from suspect cases of human rabies should be sent to the SLI for forwarding to the CDC for testing. Contact the SLI, Viral Isolation Laboratory at (617) 983-6382 for specific instructions regarding the types of specimens to submit and the proper methods for submission.

## 3) DISEASE REPORTING AND CASE INVESTIGATION

### A. Purpose of Surveillance and Reporting

- To help understand the risk of rabies in people who are bitten or exposed to animal saliva so those who are determined to be at risk can receive the proper treatment.
- Prompt reporting of animal bites to animal control officers can help prevent rabies, unnecessary treatment, and the needless killing of pets by insuring appropriate quarantine.

### B. Laboratory and Healthcare Provider Reporting Requirements

#### Human Rabies

Refer to the lists of reportable diseases (at the end of this manual's Introduction) for information.

*Note:* Due to the rarity and potential severity of human rabies, the MDPH requests that information about any known case of human rabies be **immediately reported** to the local board of health where diagnosed. If this is not possible, call the MDPH Division of Epidemiology and Immunization at (617) 983-6800 or (888) 658-2850 (weekdays), or (617) 983-6200 (nights/weekends). Normally, a confirmed human rabies diagnosis will not be made without the extensive involvement of the MDPH.

#### Administration of Rabies Post-Exposure Prophylaxis

Healthcare providers are also required to report the initiation of rabies post-exposure prophylaxis (PEP) using an official MDPH *Initiation of Rabies Post-Exposure Prophylaxis Reporting Form* (in Appendix A).

#### Animal Bites

In most cities/towns, animal bites are reportable to the local health department. Animal bites are *not* reportable to the MDPH.

### C. Local Board of Health Reporting and Follow-Up Responsibilities

#### 1. Reporting Requirements

Massachusetts Department of Public Health (MDPH) regulations (*105 CMR 300.000*) stipulate that each local board of health (LBOH) must report any case of human rabies, as defined by the reporting criteria in Section 2) A above. Refer to the *Local Board of Health Reporting Timeline* (at the end of this manual's introductory section) for information on prioritization and timeliness requirements of reporting and case investigation.

## 2. Case Investigation

- a. **The most important thing a LBOH can do if it learns of a suspect or confirmed case of human rabies is to immediately call MDPH, any time of the day or night.** Daytime phone numbers for the Division of Epidemiology and Immunization are (617) 983-6800 and (888) 658-2850. The emergency phone number for nights and weekends is (617) 983-6200.
- b. Case investigation of human rabies in Massachusetts residents will be directed by the MDPH Division of Epidemiology and Immunization.
- c. Following immediate notification of the MDPH, the LBOH may be asked to assist in investigating any case living within their communities, including gathering the following:
  - 1) The case's name, age, address, phone number, status (hospitalized, at home, deceased), and parent/guardian information, if applicable.
  - 2) The name and phone number of the hospital where the case is or was hospitalized.
  - 3) The name and phone number of the case's attending physician.
  - 4) The name and phone number of the infection control official at the hospital
  - 5) If the patient was seen by a healthcare provider before hospitalization, or was seen at more than one hospital, be sure to have these names and phone numbers as well.
  - 6) There is no official case report form required from a local board of health.
- d. Institution of disease control measures is an integral part of case investigation. It is the LBOH responsibility to understand, and, if necessary, institute the control guidelines listed below in Section 4), Controlling Further Spread.

## 4) CONTROLLING FURTHER SPREAD

### A. Isolation and Quarantine Requirements (105 CMR 300.200): Human or Animals

#### Minimum Period of Isolation of Patient

For duration of illness.

#### Minimum Period of Quarantine of Contacts

Vaccine prophylaxis of people when appropriate. Exposed animals should either be euthanized immediately or appropriately isolated and prophylaxed. (Additional information is found in the next section below, "Managing Special Situations.")

### B. Managing Special Situations

#### Protection of Humans Exposed to Animals

Domestic animals (*i.e.*, dogs, cats and ferrets) that have bitten, scratched, or otherwise exposed a human and appear healthy may be quarantined for 10 days in lieu of euthanasia and testing. Dogs, cats and ferrets that are incubating rabies will begin to exhibit signs of the disease very soon after they begin shedding virus in their saliva, so a 10-day quarantine is an effective way to detect rabies in these animals. Quarantine periods for livestock that expose humans are determined on a case-by-case basis by the Department of Food and Agriculture, Bureau of Animal Health, reachable at (617) 626-1794.

Wild animals may be classified as low, intermediate and high risk. High risk animals are those which commonly carry rabies. In Massachusetts, these include raccoons, skunks, foxes, coyotes, woodchucks and bats. Since viral shedding periods are not known for these animals, quarantine is not appropriate for these animals, and they must be euthanized and submitted for rabies testing. In most cases when these animals are unavailable for quarantine or testing they must be assumed to be rabid. Low risk wild animals almost never

carry rabies. These include small animals such as mice, squirrels, chipmunks, and wild rabbits. Bites by these animals almost never require rabies vaccination unless the circumstance surrounding the exposure was highly unusual (for instance, an unprovoked bite). Bites by trapped mice and rats, by squirrels being fed, by chipmunks and other animals captured by cats or dogs, are considered provoked, and prophylaxis is rarely warranted after such a bite. For exposure to other animals, decisions are made on a case-by-case basis. Contact the epidemiologist on-call at the Division of Epidemiology and Immunization for consultation. For more information refer to the algorithm entitled *Management of Human Exposure to Suspect Rabid Animals* (see attachment at the end of this chapter).

If an animal tests positive for rabies, humans who were exposed to the infected animal's saliva through a bite, scratch or mucous membrane should receive PEP as soon as possible. Bats pose a unique problem. The bite or scratch of a bat can be so small that it goes undetected. Persons that awaken to find a bat in their room and children alone with a bat in a room may require PEP. If an exposure cannot be ruled out and the bat is unavailable for testing, PEP should be given. For more information refer to the algorithm entitled *Management of Human Exposure to Suspect Rabid Animals* (attached at the end of this chapter).

All rabies-positive animal test results require prompt follow-up. In addition to notifying local boards of health, results from the SLI are also relayed to the epidemiologist on-call. The epidemiologist will work with local boards of health and animal control officers to obtain exposure information from victims that may need PEP. Local boards of health should work with the Department of Agriculture, Bureau of Animal Health concerning quarantines for domestic animals that may have been exposed to the rabid animal (see section below).

#### **Protection of Domestic Animals Exposed to a Rabid or Potentially Rabid Animal**

Longer quarantine periods exist for domestic animals exposed to a rabid or potentially rabid animal. The local animal control officer should make the appropriate determination for the handling of domestic animals that have been exposed to rabid or potentially rabid animals. Quarantines may range from 45 days to 6 months depending on the vaccination status of the animal. Euthanasia may sometimes be recommended. The latest recommendations and requirements concerning the quarantine of animals exposed to a rabid or potentially rabid animal can be obtained from the Department of Food and Agriculture, Bureau of Animal Health (617) 626-1794. Domestic ferret quarantines are handled by the Division of Fisheries and Wildlife, reachable at (617) 727-3151.

#### **Protection of Humans Exposed to a Rabid or Potentially Rabid Human**

Contact isolation for respiratory secretions should be in place for persons suspected or confirmed to have rabies. Articles soiled with saliva should be disinfected. Attending personnel should be protected (gloves, gowns, face protection) against any exposure to saliva. If a patient who has rabies (or is suspected of having rabies) exposes another person to saliva (through a bite, an open wound or a mucous membrane), rabies PEP of the contact should be started. Other people from the patient's home or work environment should be contacted to review their exposure.

### **C. Preventive Measures**

Control of human rabies relies upon controlling rabies in the animal population. Therefore, animal quarantine regulations and vaccination laws must be enforced.

#### **Personal Preventive Measures/Education**

Offer the following advice to the public to help prevent rabies:

- Vaccinate pets; cats, dogs and ferrets are required by law to be vaccinated. Although not required by law, livestock vaccinations are encouraged.
- Do not feed or handle wild or stray animals. Avoid sick or strangely acting animals.
- Do not touch or handle dead animals.

- If there are questions regarding capture of an animal or handling of a carcass, contact the local animal control officer.
- Cover your garbage cans and keep pets food indoors so wild animals are not attracted to it.
- Do not keep wild animals as pets. This is illegal as well as dangerous.
- Never handle bats. A bat bite or scratch may be so small as to go unnoticed. People who awaken to find a bat in their room and children, awake or asleep, with a bat in a room may require PEP. Consult with the MDPH or a healthcare provider.
- When a person calls about a secondhand exposure (usually contact with a pet that was previously bitten by a wild or potentially rabid animal), make sure the person does not touch the pet's bite wound. Suggest gloves, soap and water to clean the wound to avoid human exposure to the attacking animal's saliva.
- Recommend that travelers to developing countries with endemic rabies receive pre-exposure prophylaxis if they are going to be in situations where exposure is likely (*e.g.*, camping, hiking, backpacking or away from areas where they might receive treatment for a bite wound). Travelers should be warned to avoid petting or having other contact with stray animals.

*Note:* For more information regarding international travel and rabies, contact the CDC's Traveler's Health Office at (877) 394-8747 or through the internet at <<http://www.cdc.gov/travel>>.

The local health department should:

- Help enforce pet vaccination laws and encourage livestock vaccination.
- Help enforce quarantine periods and encourage the public to take them seriously.
- Continue rabies awareness efforts within your town.

*Note:* Rabies educational materials for the public (*e.g.*, fact sheets, brochures and pamphlets) are available from the Division of Epidemiology and Immunization by calling (617) 983-6800 or (888) 658-2850. Information regarding rabies can also be found on the MDPH website at <<http://www.magnet.state.ma.us/dph/>>.

## ADDITIONAL INFORMATION

The following is the formal CDC case definition for human rabies. It is provided for your information only; it is not necessary to use this information for reporting or investigating a case. (CDC case definitions are used by the state health department and CDC to maintain uniform standards for national reporting.) For reporting a case to the MDPH, always use the criteria outlined in Section 2) A of this chapter.

### **Clinical description**

Rabies is an acute encephalomyelitis that almost always progresses to coma or death within 10 days after the first symptom.

### **Laboratory criteria for diagnosis**

- Detection by direct fluorescent antibody of viral antigens in a clinical specimen (preferably the brain or the nerves surrounding hair follicles in the nape of the neck), or
- Isolation (in cell culture or in a laboratory animal) of rabies virus from saliva, cerebrospinal fluid (CSF), or central nervous system tissue, or
- Identification of a rabies-neutralizing antibody titer  $\geq 5$  (complete neutralization) in the serum or CSF of an unvaccinated person.

### **Case classification**

Confirmed: a clinically compatible case that is laboratory confirmed.

**Comment**

Laboratory confirmation by all of the above methods is strongly recommended.

**REFERENCES**

CDC. Case Definitions for Infectious Conditions under Public Health Surveillance. *MMWR*. 1997; 46:RR-10.

CDC. Human Rabies Prevention—United States, 1999, Recommendations of the Advisory Committee on Immunization Practices (ACIP), *MMWR*. January 8, 1999; 48:RR-1.

Chin, J., ed. *Control of Communicable Diseases Manual, 17<sup>th</sup> Edition*. Washington, DC: American Public Health Association, 2000.

Krebs, J., *et al.* Rabies Surveillance in the United States during 1998. *JAVMA*. December 15, 1999; 215:12.

MDPH. *Regulation 105 CMR 300.000: Reportable Diseases and Isolation and Quarantine Requirements*. MDPH, Promulgated November 1998, (Printed July 1999).

National Association of State Public Health Veterinarians, Inc. Compendium of Animal Rabies Control, 1999. *MMWR*. April 2, 1999; 48: RR-3.

**Attachment A:** Management of Human Exposure to Suspect Rabid Animals (2 pages)

(*Note:* Attachment A is a separate PDF file. You must go back to the *Guide to Surveillance and Reporting* main page, click on the P-R drop down menu, and then click on this attachment under Rabies.)